

Strategies for improved diagnosis and control of bacterial disease in small-scale freshwater aquaculture in South East Asia

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DFID

Freshwater aquaculture is a valuable contributor to nutritional and income demands of rural and peri-urban populations within developing countries. A range of aquatic disease conditions, in which bacterial agents are a major element, can seriously affect its productivity and development potential. Continuous low level losses from either opportunistic or facultative bacterial disease outbreaks not only affect production but can also be economically devastating for rural farmers.

Sustainable aquaculture requires effective management of the local ecosystem to achieve optimal productivity. In many inland systems, increasing organic enrichment influences the bacterial load within the system and enhances potential disease risks. A range of bacterial species can be detected in these systems, many of which are opportunistic pathogens. The innate immune defences of animals kept in good conditions can withstand a degree of bacterial challenge, but readily succumb to virulent pathogens, resulting in mass mortalities. Continued exposure to less virulent pathogens can also be detrimental, and fish under-perform if held in poor quality water. To offset losses farmers often increase stocking densities thus promoting stress-associated diseases, which exacerbate the situation.

Bacteria have been observed in head kidney macrophages isolated from healthy hybrid catfish (*Clarias spp.*) farmed in small

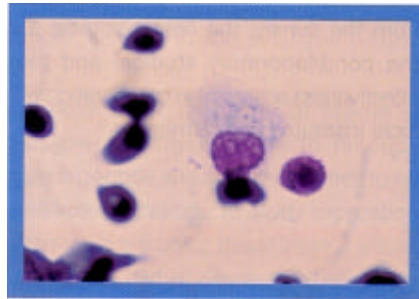


Figure 1 Bacteria within a head kidney macrophage, isolated from a hybrid catfish (*Clarias gariepinus* x *C. batrachus*) (magnification x 1000)

freshwater ponds in Thailand (Figure 1). However, these animals appeared clinically healthy with no external or internal signs of disease. This was regarded as unusual, since high levels of bacteria are not normally present in the macrophages of clinically healthy animals.

An initial 18-month study was funded by the Department for International Development (DFID) to examine the relationship between environmental conditions, bacterial load in the water and bacterial levels in tissue macrophages from a range of clinically healthy freshwater fish species, farmed in diverse culture systems in Thailand and Vietnam (Figure 2). Collaborators included Dr Kim Thompson and Dr Margaret Crumlish from the Institute of Aquaculture, Dr Supranee Chinabut and Dr. Temdoung Somsiri from the Aquatic

Animal Health Research Institute. Bangkok, Thailand, and Ms TT Dung, from the West East South Laboratory, CanTho Agricultural University, Vietnam.

The incidence of bacteria within macrophages sampled from fish cultured in the different systems was confirmed, and although levels were generally low, most macrophage preparations examined contained bacteria. The fish seemed to be able to co-exist with the systemic bacteria, appearing to be free from disease, though implications for incipient disease are not clear. It remains to be established if bacteria present in the macrophages are simply due to natural bacterial clearance, or whether in fact the presence of the bacteria immune compromise the animals to the point where they easily succumb to opportunistic infections. Many of the bacteria within the macrophages were found to be opportunistic pathogens, and as such may predispose the animal to disease. Preliminary assessment using laboratory based studies suggest that fish do succumb to opportunistic infections under stress. If this link is established, the bacterial presence within head kidney macrophages may be a useful indicator to predict potential disease outbreaks.

A field-based sampling technique has been developed to provide a quick and simple method for the isolation of macrophages at the pond-side (Figure 3). This was used to examine the relationship between water

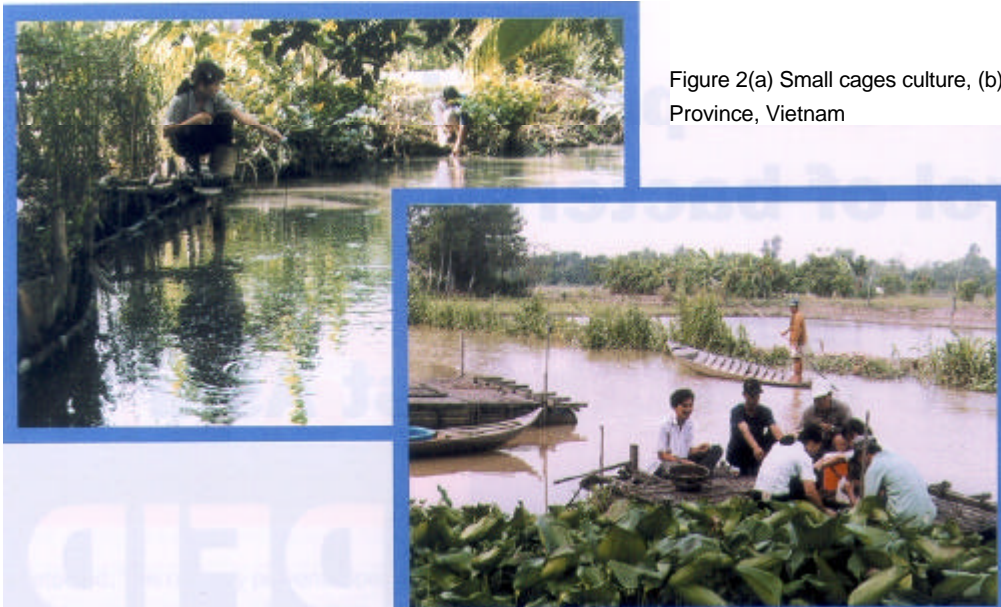


Figure 2(a) Small cages culture, (b) Monoculture pond in CanTho Province, Vietnam

quality, the bacterial load in the pond and the occurrence of bacteria within macrophages, and both positive and negative correlations were found between the different parameters examined.

It was also evident that there is a lack of knowledge of bacterial disease outbreaks in fresh water farming systems in Thailand and Vietnam, and the impact that they have on sustainable rural aquaculture. Without this information effective control strategies cannot be developed for the region.

A project is currently being funded by DFID to produce strategies for improved diagnosis and control of bacterial disease in small-scale freshwater aquaculture in South East Asia. A survey is presently being carried out to establish the incidence of bacterial disease in a diverse range of fish species and culture systems in Thailand and Vietnam, and will be used to examine the relationship between disease outbreaks, husbandry practices and environmental conditions. Indicators of potential disease outbreaks are being established through field sampling, using the pond-side macrophage isolation technique, and pond and laboratory-based studies. The clinical significance of bacteria resident within macrophages of healthy fish will also be determined.

Guidelines for the control of bacterial disease in rural farming systems will be developed using the information collected

from the survey, the field sampling and the pond/laboratory studies, and their effectiveness assessed in collaboration with local Institutes and farmers.



DR MAGS CRUMLISH recently obtained her PhD from the Institute of Aquaculture, University of Stirling. Her thesis was on the innate immune mechanisms of tropical farmed frogs and much of the practical work was conducted at Aquatic Animal Health Research Institute, Bangkok, Thailand. She is currently employed as a Research Fellow at the Institute of Aquaculture on a DFID funded project with Dr Kim Thompson. This project is in its second phase and is focusing on the impact and control of bacterial diseases in small-scale freshwater fish farms in southern Vietnam and Thailand. Over the last year she has also been involved in activities examining the livelihoods of small-scale farmers in central and Northern Vietnam in

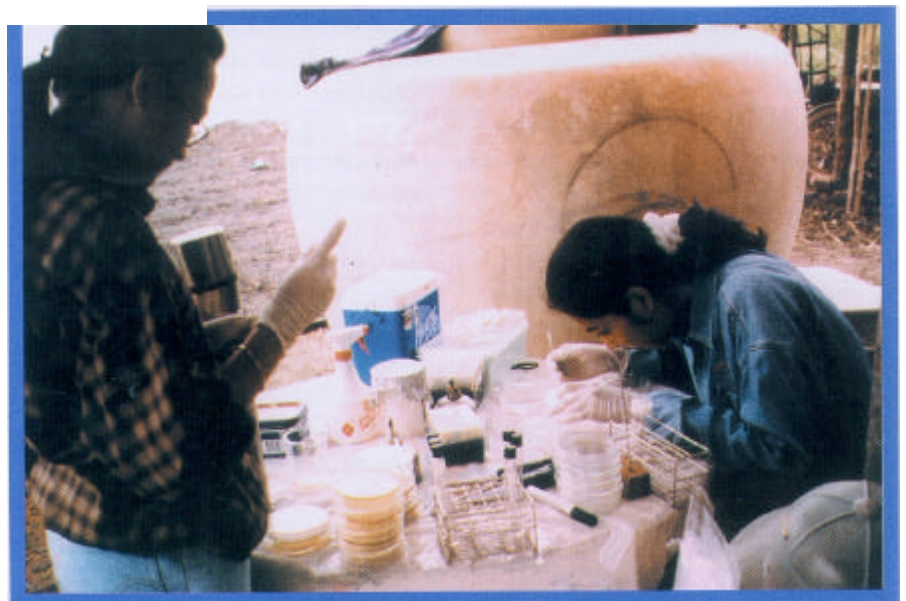


Figure 3 Isolation of head kidney macrophages at a farm site in Supanburi Province, Thailand